

September 7, 2005

PT

TO: Distribution

FROM: PT/Program Manager, Advanced Life Support

SUBJECT: Final Report for the Physics of Colloids in Space Experiment

We are pleased to distribute copies of the final report for the Physics of Colloids in Space (PCS) experiment. Professor David A. Weitz of Harvard University and his science team conducted the subject experiment on board the International Space Station from May 2001 through February 2002. The experiment was highly successful, and has resulted in four papers, two of which have been published in Physical Review Letters (September 2004, July 2005). In addition, numerous other papers have been published based on the related ground-based experiments. The PCS investigation originated from a proposal awarded via a 1991 NASA Research Announcement (NRA).

The objective of PCS was to address key problems in the physics of colloidal particles, including the nucleation, growth, and properties of binary colloidal alloys, the structure, stability, and equilibrium properties of colloidal particles with attractive interactions induced, in a controllable fashion, by adding polymers, and the structure, dynamics, and mechanical properties of large scale fractal aggregates. The details of the nucleation, growth rate and morphology for all these classes of fluids in the absence of gravity were measured to compare with the theoretical predictions. Long-term microgravity was required because most of the structures require extended periods of time to nucleate and grow, during which time sedimentation effects must be completely eliminated to ensure that the desired alloy structure is produced.

The Physics of Colloids in Space (PCS) experiment was accommodated within International Space Station (ISS) EXpedite the PROcessing of Experiments to Space Station (EXPRESS) Rack 2 and was remotely operated from May 2001 until February 2002 from NASA Glenn Research Center's Telescience Support Center (TSC) in Cleveland, Ohio, and from the remote site at Harvard University in Cambridge, Massachusetts. PCS was launched on April 19, 2001 on Space Shuttle STS-100 (ISS Flight 6A.) The experiment was activated on May 31, 2001. The entire experimental setup performed remarkably well, and accomplished 2400 hours of science operations on-orbit. The sophisticated instrumentation in PCS is capable of dynamic and static light

scattering from 11 to 169 degrees, Bragg scattering over the range from 10 to 60 degrees, dynamic and static light scattering at low angles from 0.3 to 6.0 degrees, and color imaging.

The long duration microgravity environment on the ISS facilitated extended studies on the growth and coarsening characteristics of two binary crystal alloys, the demixing of the colloid-polymer critical-point sample as it phase-separated into two phases, and gelation rate studies in two extremely low concentration fractal gels. The final report is comprised of four papers that discuss the results from these experiments plus a paper describing the PCS apparatus itself.

The PCS data consists of 24 gigabytes of data on seven (7) digital video disks (DVDs). The DVDs contain both science and housekeeping data collected onboard the International Space Station from May 2001 to February 2002, as well as programs to display image files and convert raw data files to ASCII text files. All of these programs are designed to run in a WIN32 environment, such as Windows NT 4.0 or Windows 2000.

The PCS experiments have yielded a tremendous amount of fresh data and knowledge about colloids. The flight hardware was put into bonded storage in March 2004 to support the possibility of a reflight to the International Space Station to perform additional investigations of merit to the field of colloidal science.

If you have any questions about this data, contact the Principal Investigator, Professor David A. Weitz at 617.496.2842 or weitz@deas.harvard.edu. The NASA GRC contacts are Dr. Subramanian Sankaran, Project Scientist, 216.433.9335 or Subramanian.Sankaran@grc.nasa.gov and Michael P. Doherty, Project Manager, 216.433.6641 or Michael.Doherty@grc.nasa.gov.

Sincerely,

<Original signed by Fred J. Kohl>

Fred J. Kohl

Enclosure: Physics of Colloids in Space Final Report

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